National Aeronautics and Space Administration

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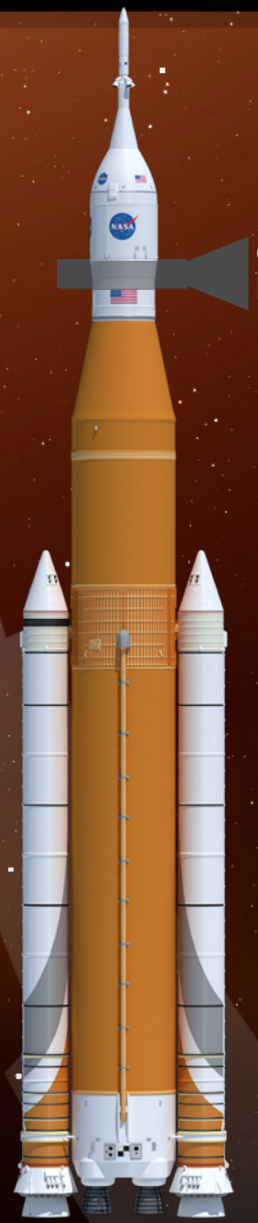
SPACE LAUNCH SYSTEM

DEEP-SPACE DEPLOYMENT FOR SMALLSATS

Andrew Schorr
NASA Space Launch System
May 2017

www.nasa.gov/sls

SLS BLOCK 1 CONFIGURATION



Overview

- Initial configuration of vehicle optimized for near-term heavy-lift capability
- Completed Critical Design Review in July 2015

SLS Block 1

Capability: >70 metric tons

Height: 322 feet (98 meters)

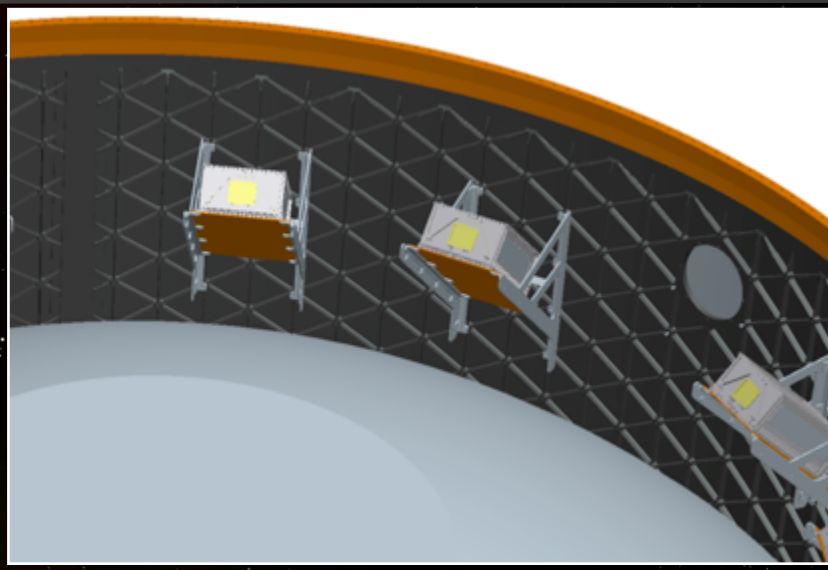
Weight: 5.75 million pounds (2.6 million kg)

Thrust: 8.8 million pounds (39.1 million Newtons)

Available: 2019

Secondary Payloads

On Exploration Mission-1, SLS will include thirteen 6U payload locations of up to 14kg per CubeSat



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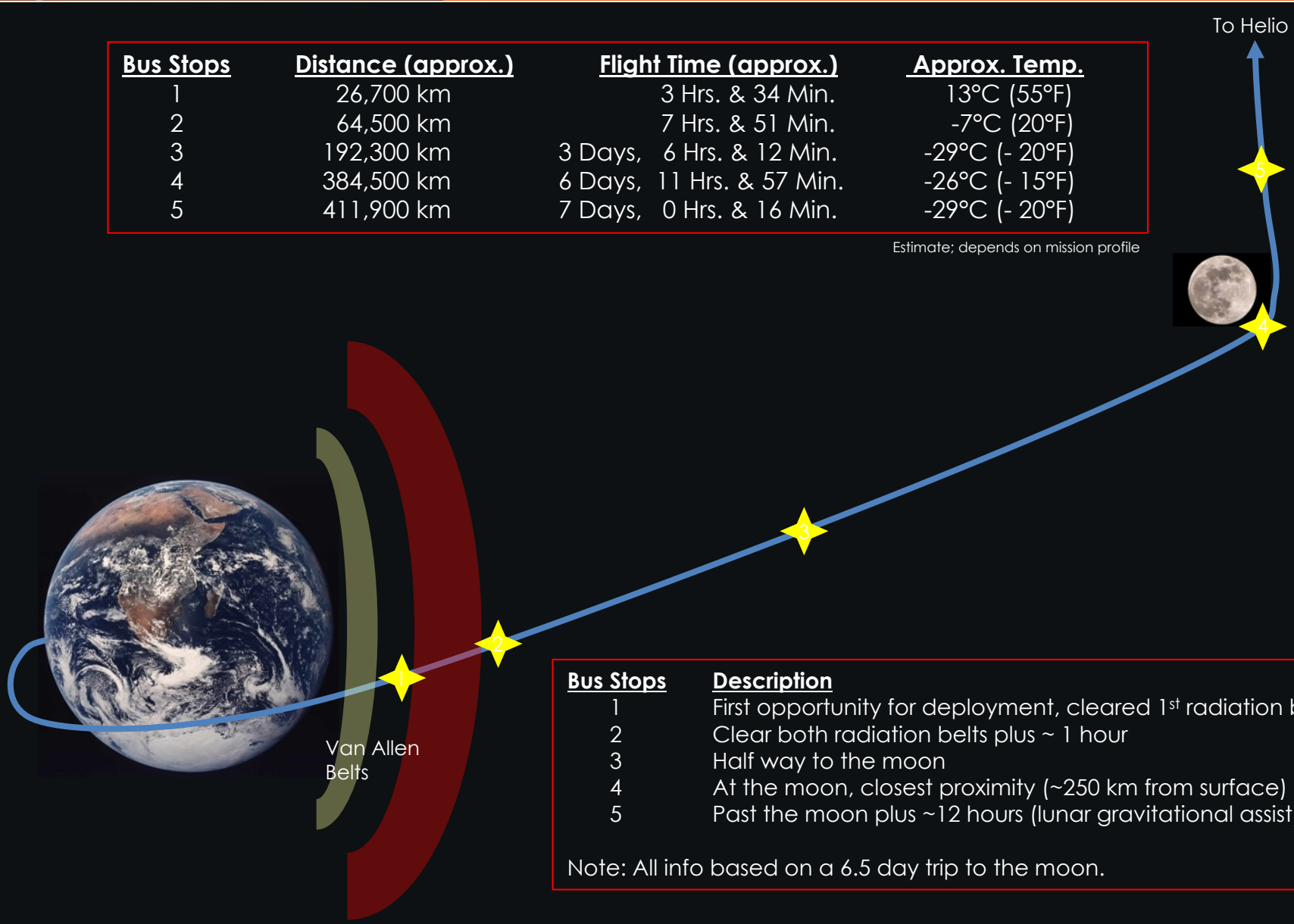
EM-1 CUBESAT BUS STOPS

Bus Stops	Distance (approx.)	Flight Time (approx.)	Approx. Temp.
1	26,700 km	3 Hrs. & 34 Min.	13°C (55°F)
2	64,500 km	7 Hrs. & 51 Min.	-7°C (20°F)
3	192,300 km	3 Days, 6 Hrs. & 12 Min.	-29°C (- 20°F)
4	384,500 km	6 Days, 11 Hrs. & 57 Min.	-26°C (- 15°F)
5	411,900 km	7 Days, 0 Hrs. & 16 Min.	-29°C (- 20°F)

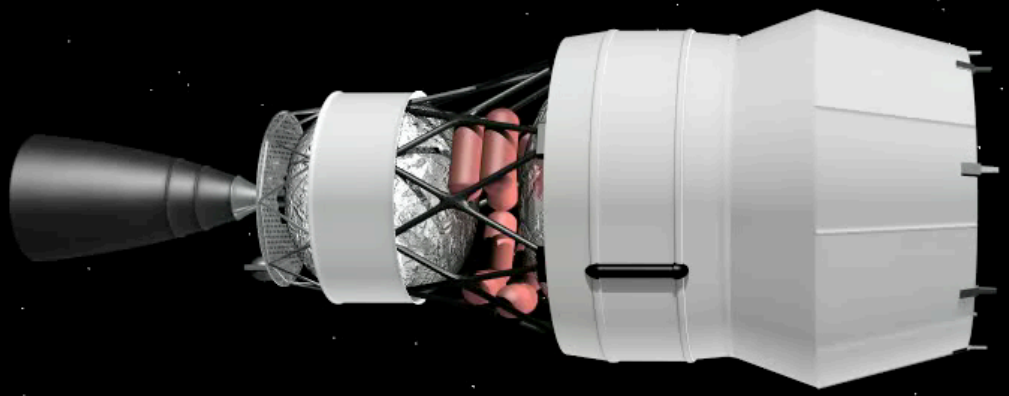
Estimate; depends on mission profile



Bus Stops	Description
1	First opportunity for deployment, cleared 1st radiation belt
2	Clear both radiation belts plus ~ 1 hour
3	Half way to the moon
4	At the moon, closest proximity (~250 km from surface)
5	Past the moon plus ~12 hours (lunar gravitational assist)

Note: All info based on a 6.5 day trip to the moon.

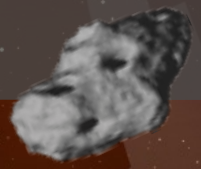
CUBESAT DEPLOYMENT



ONE LAUNCH, MULTIPLE DISCIPLINES

Moon

- Lunar Flashlight (NASA)
- Lunar IceCube (Morehead State University)
- LunaH-Map (Arizona State University)
- OMOTENASHI (JAXA)



Asteroid

- NEA Scout

Sun

- CuSP (Southwest Research Institute)

Earth

- EQUULEUS (JAXA)
- Skyfire (Lockheed Martin)

And Beyond

- Biosentinel (NASA)
- ArgoMoon (ESA/ASI)
- Three Centennial Challenge Winners (TBD)

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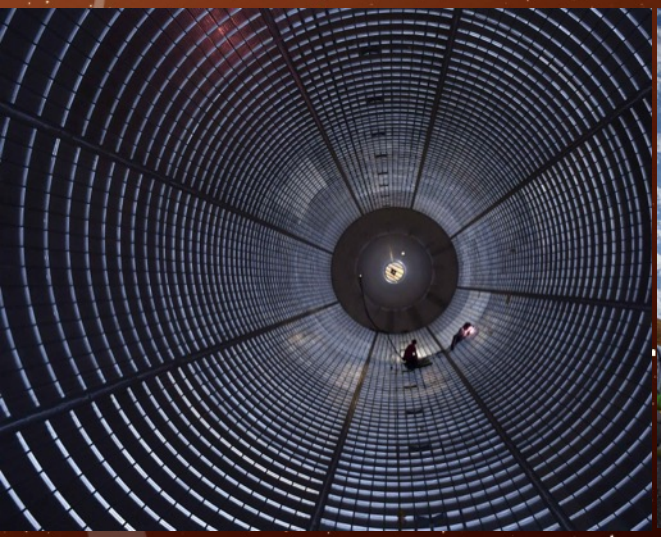
PROGRESS TOWARD LAUNCH



Core Stage production at Michoud

Booster testing at Orbital ATK

Engine testing at Stennis Space Center

Upper stage prep at Cape Canaveral

Structural testing at Marshall

Ongoing work for Block 1B

SLS BLOCK 1B CONFIGURATION

OVERVIEW

- Replaces Interim Cryogenic Propulsion Stage with human-rated Exploration Upper Stage
- EUS has completed checkpoint prior to Preliminary Design Review

SLS Block 1B

Capability: >105 metric tons

Height: 364 feet

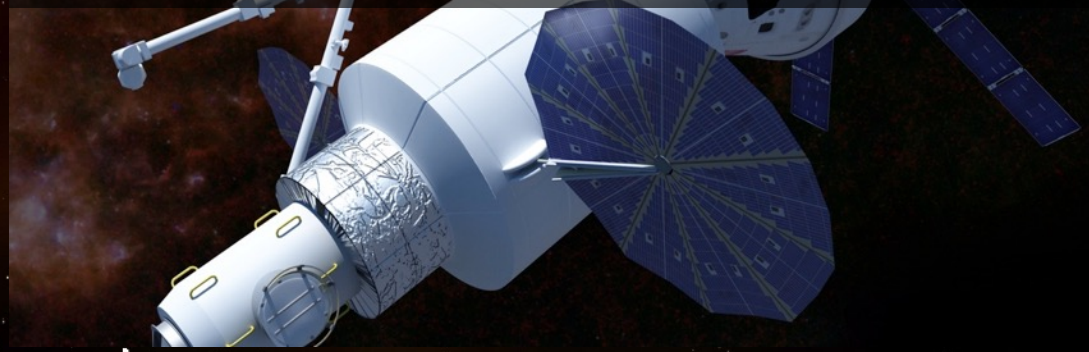
Weight: 6 million pounds

Thrust: 8.8 million pounds

Available: No earlier than 2021

UTILIZATION

- Supports launch of Orion and co-manifested exploration systems in "Proving Ground" of cislunar space
- With large 8.4-meter fairing, can launch game-changing science missions and other high-priority payloads



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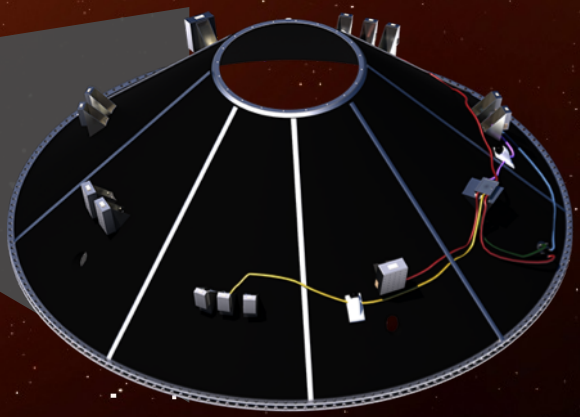
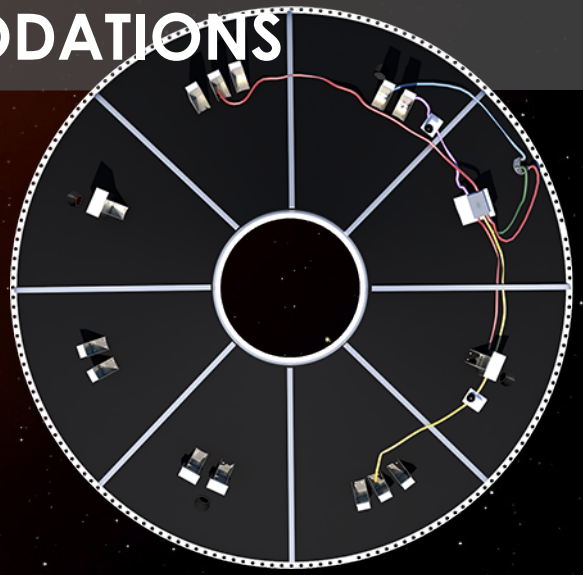
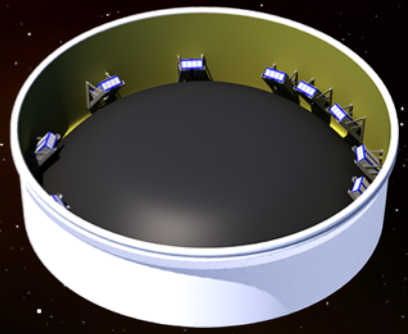
BLOCK 1 & BLOCK 1B COMPARISON

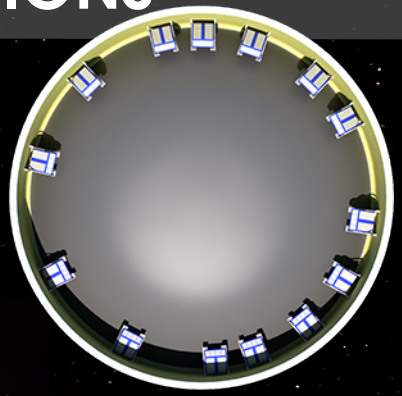
BLOCK 1B ACCOMODATIONS





BLOCK 1 ACCOMODATIONS





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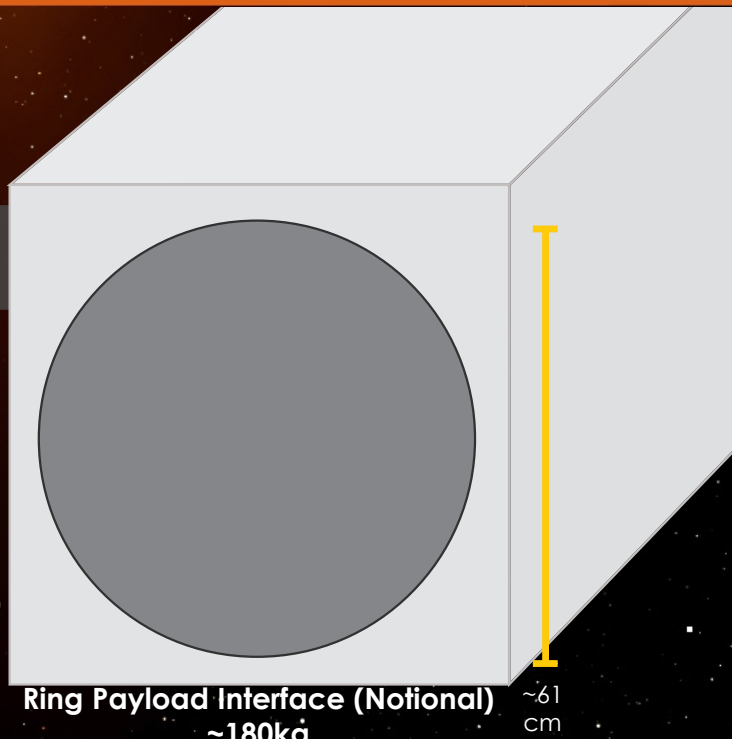
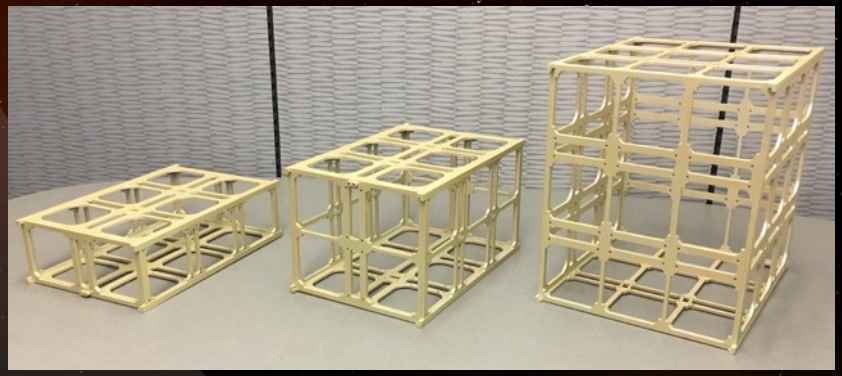
BLOCK 1B SMALL PAYLOAD OPTIONS

VOLUME AND MASS RANGE





Summary

- SLS provides a unique opportunity for the CubeSat/smallsat community
  - Enables access to Earth, Moon, Sun & Deep Space
  - Opportunity to manifest payloads from 6U/12U/27U to ESPA-Class
- First Flight (EM-1) hardware production in-progress
  - Block 1B initiating procurement/production activities

More Information

- SLS Mission Planner's Guide (ESD 30000)
  - Provides future payload developers/users with information to support preliminary SLS mission planning
  - Covers Block 1B (105mT*) & Block 2 (130mT*) configurations
  - Copies can be requested by email to: NASA-slspayloads@mail.nasa.gov

* Payload Mass to Low Earth Orbit